

REMARKS

This Amendment is submitted in response to the outstanding Office Action, dated March 2, 2006. Claims 1, 3, 4 and 5 are proposed for amendment herein. Claim 12 is newly added. Claims 1-5 and 12 are presently pending in the above-identified application.

Allowable Subject Matter

As the Examiner will appreciate, the Applicants were surprised by the new rejection made in the outstanding Office Action. Applicants had expected that the next paper to issued by the Examiner in the normal course would have been a Notice of Allowance. Nevertheless, Applicants wish to again thank the Examiner for the indication in the outstanding Office Action, page 10, that claims 3 and 4 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. To that end, Applicants have amended and rewritten dependent claims 3 and 4 in independent form (including all of the limitations of the base claim and any intervening claims from which such originally filed dependent claims ultimately depended) herein and respectfully submit that such pending independent claims are in condition for allowance.

Regarding the rejection of dependent claim 5, Applicants have amended such claim to indicate dependency from rewritten independent claim 3 as set forth above. Similarly, newly added dependent claim 12 depends from rewritten independent claim 4 as set forth above. In view of the aforementioned Examiner's indication of allowability and that these dependent claims contain all the limitations of the amended independent claims from which they depend, Applicants submit that these dependent claims are also presently in condition for allowance.

Rejection of Claim 1 under 35 USC § 102(b)

The Office Action rejected independent claim 1 under 35 USC § 102(b) as being anticipated by Japanese Publication No. 2001-114185 of U. Masahiro et al. (hereinafter the “JP (‘185) reference”). Applicants have amended independent claim 1 herein to more particularly claim a further aspect of the invention, and respectfully submit that such amended independent claim is patentably distinct from the JP (‘185) reference for at least the reasons set forth hereinbelow. That is, Applicants’ have included certain additional structural limitations in amended independent claim 1 herein and respectfully submit that such amended claims is patentably distinct over the JP (‘185) reference.

In particular, while Applicants respectfully submit that independent claim 1 already had sufficient structural elements to distinguish over the JP (‘185) reference (for at least the reasons set forth in Applicants previously filed Amendment, dated October 31, 2005) Applicants have further amended independent claim herein to include additional structural limitations directed to a further aspect of the invention regarding the particular structural orientation of the claimed nanostructure pattern disposed on the surface of the body. In particular, in accordance with the aspect of the invention set forth in amended independent claim 1, each nanostructure of said plurality of nanostructures maintaining an orientation that is perpendicular to the surface of the body such that as the body moves through said fluid said fluid travels in a direction across a top of each said nanostructure. Further, Applicants have introduced a structural limitation (i.e., the claimed “first electrode”) with regard to the delivery of the electrically-induced penetration of the fluid through the nanostructures (see, e.g., Applicants’ Figures 8-11 and the associated description thereof on pages 11-13 of the Specification).

As set forth in Applicants’ prior Amendment, Applicants understand the JP (‘185) reference to disclose a method for reducing resistance of a ship’s hull through the use of very fine grooves formed along the direction of seawater in the surface of a ship’s outside plating wherein the grooved surface is also treated with an anti-fouling treatment to increase the resistance of the hull from marine organism adhesion (see, e.g., the JP (‘185) reference, Abstract; and page 1, paragraphs [0001] through [0011]). The JP (‘185) reference does not teach or suggest the Applicants’ claimed invention, as set forth in the

amended claims herein, where drag reduction is achieved through the utilization of nanostructures or microstructures disposed on a surface in a way such that the contact between the surface and a fluid is reduced and the claimed friction control between the surface and the fluid is controlled as a function of a surface energy of the nanostructures or microstructures and wherein the friction control is a function of a variable degree of contact between the surface and the fluid resulting from an electrically-induced penetration of at least a portion of said fluid through the nanostructures or microstructures.

Further, the JP ('185) reference does not teach or suggest the structural limitations with respect to the particular structural orientation of the claimed nanostructure pattern disposed on the surface of the body and/or a structural limitation with regard to the delivery (i.e., the claimed "first electrode") of the electrically-induced penetration of the fluid through the nanostructures, as now required by Applicants' amended independent claim 1.

In view of the foregoing, Applicants respectfully request that the rejection of pending independent claim 1, as amended, be withdrawn.

Rejection of Claims 1, 2 and 5 under 35 USC § 103(a)

The Office Action rejected claims 1, 2 and 5 under 35 USC § 103(a) as being unpatentable over German Patent No. DE 19704207A1 (hereinafter the "DE ('207) reference") in view of Japanese Publication No. 08-128413 of S. Fumio et al. (hereinafter the "JP ('413) reference"). Applicants have previously submitted, concurrent with the prior Amendment, an English translation of such German reference; also all citations herein by Applicants regarding this German reference are citations to the English translation thereof. Applicants respectfully submit that the amended claims herein are patentable over the DE ('207) reference and the JP ('413) reference taken alone or in any combination.

First, Applicants note that in the Office Action on page 9 the Examiner indicated in the "Response" that certain points of Applicants' argument set forth in the prior Amendment were not considered. To address this inaction, Applicants have amended independent claim 1 with respect to a further aspect of the invention. As such, with the

amendments made to currently pending claim independent claim 1 Applicants respectfully submit that such claim is neither taught or suggested by DE ('207) reference and the JP ('413) reference taken alone or in any combination, as further discussed below, and request that the Examiner reconsider all points made by Applicants in distinguishing Applicants' claimed invention over the cited prior art.

With respect to the DE ('207) reference, Applicants wish to first highlight that the friction reduction technique described therein is primarily directed at a technique for suppression of turbulent drag and affecting a turbulent envelope. While the Examiner on page 9 of the Office Action appears to indicate there is some difference with respect to the teachings of this reference (i.e., Figures 1-3 vs. Figures 4-7), such position is not supported with any particularity in the Office Action, nor is such position supported by the teachings of the DE ('207) reference as understood by Applicants. That is, turbulent drag is reduced by changing/affecting the overall turbulent envelope in which the body is immersed. See, for example, bottom of page 3 through top of page 4 which states "...This is based on the fact that vortices do not form on hair ends, which statically repel the water from the floating body, and, in this way, reduces the friction by the air cushions formed opposite a smooth surface of a body moved in the water...". The description of such vortices is an indication that the DE ('207) reference is suppressing turbulent drag by affecting/influencing the turbulent envelope. As with Meng, this is not particularly relevant to the present invention. That is, in contrast to the DE ('207) reference (and Meng), as discussed in the prior Amendment and further detailed hereinabove, Applicants' claimed invention is directed to "skin" drag reduction without concern with (or influence of) turbulent drag or turbulent envelope due to the reduction in the liquid-solid interface achieved by the application of Applicants' nanostructures (or microstructures) on the surface of the body moving through the fluid. That is, applying the principles of Applicants' claimed invention allows a reduction in the contact area of the body's surface which actually comes in contact with the fluid in which such body is immersed thereby achieving the desired friction control.

In further regard to the DE ('207) reference, the disclosed technique also details a floating body that requires that the fibers are laid down (i.e., flat) and with their free ends pointing in a direction opposite the direction to movement to reduce drag (see, e.g., the

DE ('207) reference at the Abstract; and page 2 and page 3). Further, the DE ('207) reference discloses the application of a conductive coating to the floating body's surface such that application of an electrical charge brings about an ionization of the water surrounding the floating body so that the friction of the moving floating body is reduced in the water (see, e.g., the DE ('207) reference, page 4, first and second paragraphs discussing Figure 4 and Figure 5, respectively). This ionization effect and migration of the water surrounding the floating body does not teach or suggest the aspect of Applicants' claimed invention wherein friction control is a function of a variable degree of contact between the surface and the fluid resulting from an electrically-induced penetration of at least a portion of said fluid through the nanostructures or microstructures.

As is readily seen from Applicants' specification and the associated Figures described therein, and in accordance with an aspect of Applicant' invention set forth in amended independent claim 1 herein, the claimed nanostructures or microstructures are not laid flat as would be required by the cited DE ('207)/JP ('413) reference combination. This distinguishing feature of Applicants invention, as set forth in amended claim 1, is due to the fact that if Applicants' claimed nanostructures were laid flat the combination of electrowetting principles and such nanostructure/microstructure surfaces of the claimed invention will be ineffective.

The JP ('413) reference discloses a method of decreasing fluid resistance by bonding a knit fabric upon which microstructures are erected to provide a contact surface which is in contact with the fluid for changing the structure of the viscous sub-layer such that large-scale eddy structures are controlled, consequently decreasing turbulent flow frictional resistance (see, the JP ('413) reference at the Abstract; column 1, paragraph [0008]; and column 3, paragraph [0022]).

So, the combination of the DE ('207) reference and the JP ('413) reference as set forth by the Office Action (1) delivers whatever friction control through suppression of turbulent drag and affecting a turbulent envelope, and (2) in certain forms will require that the fibers are laid flat and with their free ends pointing in the opposite direction of the movement through the fluid, and (3) that a conductive coating may be applied to the surface the floating body's surface such that application of an electrical charge brings

about an ionization of the water surrounding the floating body so that the friction of the moving floating body is reduced in the water.

Clearly, however, for the at least the reasons discuss above any combination of the DE ('207) reference with the JP ('413) reference, at a minimum, does not teach or suggest Applicants' claimed invention because Applicants' claimed invention requires that the claimed friction control between the surface and the fluid is controlled as a function of a surface energy of the nanostructures or microstructures and wherein the friction control is a function of a variable degree of contact between the surface and the fluid resulting from an electrically-induced penetration of at least a portion of said fluid through the nanostructures or microstructures.

Further, In addition, the ionization effect achieved in the cited DE ('207)/JP ('413) reference combination between the conductive coating and surrounding water is unrelated to the electrowetting principles of the instant invention which are employed to cause the fluid to at least partially penetrate the nanostructures (or microstructures) on the surface of the body in order to selectively create greater friction in a desired location of the surface. Said another way, even assuming *arguendo* that the cited DE ('207)/JP ('413) reference combination is proper, one skilled in the art would not understand such combination to teach or suggest achieving friction control is a function of a variable degree of contact between the surface and the fluid resulting from an electrically-induced penetration of at least a portion of said fluid through the nanostructures or microstructures, as claimed by Applicants.

Further, regarding the Office Action's assertion on page 5 (in rejecting Applicants' claim 5) that the cited DE ('207) reference by " a mere presence or absence of electric current on the fibers will cause a variable penetration of fluid through the microstructures...". Applicants find such a reading unsupported by such reference. To establish a proper *prima facie* case of obviousness, three basic criteria must be met: (1) there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art to modify the reference or to combine reference teachings; (2) there must be a reasonable expectation of success; and (3) the prior art reference (or references when combined) must teach or suggest all the claim limitations. (See, Manual of Patent Examining Procedure (MPEP), Eight

Edition, August 2001, as revised May 2004, § 706.02(j)). The Applicants respectfully submit that the Office Action fails to make a *prima facie* case of obviousness with regard to any of Applicants' pending claims, as amended herein, for at least the reasons hereinbelow.

Further, with respect to Applicants' amended dependent claim 5 and newly added dependent claim 12, these claims are directed to a further aspect of the invention wherein the fluid is caused to penetrate the pattern of nanostructures or microstructures at a select location on the surface such that the penetration of the fluid at the select location alters a direction or a speed of the vehicle in the fluid (see, e.g., Applicants' Specification, page 2, lines 20-22; and page 12, line 27 through page 13, line 8). The DE ('207)/JP ('413) combination does not teach or suggest this further aspect of Applicants' claimed invention. Further the JP ('413) reference is directed to affecting the turbulent envelope/turbulent flow (similar to the previously cited Meng reference as mentioned above) and not utilizing a pattern of nanostructures or microstructures at a select location on the surface such that the penetration of the fluid at the select location alters a direction or a speed of the vehicle in the fluid, as claimed by Applicants.

Therefore, Applicants respectfully submit that neither the DE ('207) reference or the JP ('413) reference, taken alone or in any combination, teach or suggest the notion where fluid is caused to at least partially penetrate the nanostructures or microstructures on the surface of the body in order to selectively create greater friction in a desired location of the surface thereby creating drag that alters the speed or direction of a body itself as it is propelled through the fluid, as claimed by Applicants in pending dependent claims 5 and 12 herein.

Further, regarding the rejection of dependent claim 2, such claim depends from one amended independent claim 1 which Applicants submit are patentably distinct over the DE ('207) reference and the JP ('413) reference for the aforesaid reasons. Thus, this dependent claim contain all the limitations of amended independent claim 1 from which such claim depends, and Applicants respectfully submit that this dependent claims is also patentably distinct over the DE ('207) reference and the JP ('413) reference for the aforesaid reasons, as well as other elements this claim adds in combination to the base claim.

In view of the foregoing, Applicants respectfully submit that each of the currently pending claims, as amended, are patentably distinct over the DE ('207) reference and the JP ('413) reference, either taken alone or in any combination, therefore, Applicants respectfully submit that each of the currently pending claims in the application is in condition for allowance and reconsideration is requested. Favorable action is respectfully requested.

Should the Examiner believe anything further is desirable in order to place the application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,



Donald P. Dinella
Attorney for Applicant(s)
Reg. No. 39, 961
(908) 582-8582

Date: May 9, 2006

Docket Administrator (Room 3J-219)
Lucent Technologies Inc.
101 Crawfords Corner Road
Holmdel, NJ 07733-3030